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TRIADS, EMPHATICS AND INTERDENTALS IN ARABIC SOUND SYSTEM TYPOLOGY

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Abstract

A triadic system of (obstruent) contrasts is a well-known feature of the prototypical Semitic sound system and involves an opposition of voiced – voiceless – emphatic. The 'emphatic' member of this triad varies across Semitic languages between ejective, pharyngealized / uvularized, and some combination of both. Emphatics in the Ethio-Semitic languages are ejective, while in Arabic they are pharygealized / uvularized. There has been much debate in the literature of the exact nature and behaviour of the emphatics in Arabic, and it is clear that there is considerable dialectal variation in both phonetic realization and phonological behaviour. Further, there is also variation in the exact emphatics that each dialect has, and very often debate over identifying which phones of a given dialect are emphatic ('primary', i.e. lexical, or 'secondary', i.e. phonetically or phonologically conditioned). This paper focuses on a little-investigated aspect of Arabic emphatics, which is that of laryngeal categories. Data is presented to show that Arabic dialects may be classified as either triadic, with a three-way laryngeal contrast, or dyadic, with a two-way laryngeal contrast. The triadic dialects have a voiced – voiceless (emphatic) – voiceless aspirated opposition in the obstruent system, which is akin to the prototypical Semitic triadic system; the dyadic dialects have only a voiced – voiceless obstruent opposition. The paper shows how these categories are measured, exemplifying with a number of triadic and dyadic dialects. These data additionally show that triadic or dyadic systems do not emerge in an entirely arbitrary fashion: there appears to be a strong correlation between the type of laryngeal contrast system and the dialect type according to other classification criteria (e.g. socio-economic or 'ecological' along a Bedouinite–ruralite–urbanite continuum). The triadic / dyadic laryngeal contrast systems of Arabic provide further evidence for a trajectory of emphatic development from ejective (a purely laryngeal contrast) to pharyngealized / uvularized (a resonance contrast). The paper presents and exemplifies a model of this trajectory and discusses the changing role of 'emphatic' within Semitic. Having shown how laryngeal contrasts in Arabic are an important part of the typology of emphatics, the paper then discusses how other, related features of the sound system are also relevant. The final part of the paper therefore outlines how the retention or loss of (historical) interdentals may be incorporated into such a typology. The hypothesis is that this variant, too, will show a strong correlation with triadic / dyadic laryngeal contrast systems; while exceptions are predicted to be found, representing 'mixed' dialect types, preliminary observations indicate that there may indeed be a good correlation.

0 Introduction

There is much discussion in the literature of the Arabic emphatics, with a wide range of studies focusing on the phonetic correlates (both articulatory and acoustic) of 'emphatic' and a wide range of studies focusing on the phonological representation and behaviour of 'emphasis'. This paper shows how Arabic emphatics are an important part of a historical rearrangement within Arabic dialect sound systems that is ongoing. To this end, the paper focuses on a little-discussed aspect of emphatics, that of laryngeal categories.

Section 1 gives a background on emphatics, overviewing their status firstly in Arabic (1.1) and then in the Ethio-Semitic languages (1.2). I then contextualize the issue at hand in Section 2, noting the debate over the earlier, prehistoric identity of the Semitic emphatics. I discuss the 'ejectives' hypothesis and lay out a model of the series of triads that may be set up for Semitic, and which are seen to be a typical feature of the Semitic sound system, despite some divergences today. In Section 3, I look more closely at laryngeal categories cross-linguistically and show how these are measured phonetically. Section 4 then exemplifies laryngeal categories in a number of different Arabic dialects (e.g. rural-Bedouinite Syrian, urban Syrian, *gilit* Mesopotamian, peninsular Arabian, etc.). With such analysis, Arabic dialects can be classified as dyadic or triadic, which demonstrates the changing function of 'emphatic' within Semitic. In the case of modern Arabic dialects, this type of variation in laryngeal settings is an intrinsic part of the sound system. In Section 5, I show how the triadic / dyadic variation

extant in Arabic dialects is part of a trajectory of emphatic development, meaning that Arabic dialects themselves contribute to the evidence for such a trajectory from ejective (laryngeal contrast) to pharyngealized / uvularized (resonance contrast).

In order to further develop this typology, Section 6 of this paper introduces another dialectal variant which is relevant to the development of emphatics. The functional change of 'emphatic' within Arabic sound systems has allowed the triad / dyad series to line up differently, so that in dialects where the three-way laryngeal contrast has merged to a two-way contrast, we find a series of dyadic contrasts (between *t–d*, *ṭ–ḍ*, and so on). A factor which is relevant to this is the retention or neutralization of the interdental series. I demonstrate this for Baghdadi and Damascene Arabic. While the extent to which this re-lining up is itself still in transition is not yet completely clear, we could expect to find a strong correlation between interdental loss and two-way laryngeal contrast dialects, as I show for Mashriqi Arabic dialects; we are nevertheless likely to see some exceptions, exemplifying a continuum (or trajectory of development) between the two types of system.

I conclude in Section 7 with a summary of the findings presented and a discussion of ongoing work.

1 Emphatics across Semitic: Background

Emphatics are not realized uniformly across the Semitic languages of today; they have varying phonetic interpretations and phonological functions. This section presents a brief overview of what is usually meant by the term 'emphatic', and the two most well-known alternative realizations, the 'backed' emphatic typical of Arabic, and the ejective emphatic typical of the Ethio-Semitic languages. This paper does not discuss the Modern South Arabian (MSA) languages in detail, since the focus here is on Arabic and the two endpoints of the trajectory from ejective to 'backed' emphatic. The phonetic and phonological status of the emphatics in MSA is complex, although they may be seen as representing an intermediate stage on this trajectory.[1] The status of emphatics in Neo-Aramaic is also not entirely clear, although again Neo-Aramaic varieties that have been investigated seem to represent intermediate stages on the emphatic trajectory, as proposed by Dolgopolsky, a model of which is presented in Section 5, below.[2]

1.1 Arabic Emphatics

There has been a vast amount written about Arabic emphatics, ranging from the descriptions of the medieval Arab grammarians and more recent Western grammars of the various dialects of Arabic, to acoustic and articulatory phonetic investigations, and analyses within the frameworks of various theories of phonology.

The general consensus tends to be that Old Arabic ('primary') emphatics were *ṣ ṭ ḍ*[3] *ḍ̲*.[4] This is not uncontroversial, as it seems likely that there was neutralization between *ḍ* and *ḍ̲* in most older dialects,[5] although *ḍ* and *ḍ̲* were inherited as distinct segments from earlier Semitic, are taken to be distinct in Classical and Modern Standard Arabic, and remain orthographically distinct. Most spoken dialects of Arabic today[6] have *ṣ* and *ṭ*, alongside either *ḍ* (~*ẓ*) or *ḍ̲*, where these have merged. Additionally, most contemporary varieties of Arabic (Neo-Arabic dialects) have emphatic *ḷ* and *ṛ*,[7] which may be more or less marginal, depending on the dialect and the analysis. Other emphatic consonants have been argued to be phonemically distinct in various dialects, including most commonly *ṃ* and *ḅ*.[8] These emphatics are traditionally seen as 'primary', i.e. phonemic, or lexically distinctive, and may cause the spreading of the emphatic quality to other segments, both vowels and consonants (the latter most often in a leftwards, regressive process). The spreading of the emphatic quality has been the subject of much debate in the literature and need not detain us further here.[9]

In most varieties of Arabic, the emphatics are a set of consonants that contrast with a set of 'plain' counterparts; the emphatic consonants are distinguished by 'backing', i.e. they are produced with a secondary articulation that consists predominantly of some degree of pharyngealization or uvularization (i.e. constriction in the upper pharyngeal area).[10] In conjunction with the pharyngeal constriction, in some dialects the emphatics are also produced with markedly rounded and protruding lips, and this may also spread into other segments.[11] At the very least, a distinguishing articulatory feature concomitant with the pharyngeal constriction is a non-spread lip position, in that the contrasting non-emphatic consonants are produced with some degree of lip spreading.[12]

Arabic dialects differ in the exact phonetic realization of 'emphatic', and there is much debate in the literature over what the exact phonetic correlates of 'emphatic' are, depending on dialect.[13] In general, it can be summarized that the most common phonetic correlate of the emphatic feature in Arabic is at least some degree of pharyngealization and tongue-backing, with non-spread lips and jaw-lowering; additionally, some dialects have concomitant labialization.[14]

Auditorily, Arabic emphatics may be perceived as 'dark' or 'hard' in comparison with the 'plain' counterparts, which may be perceived as 'light'. This could be compared with the difference between the realizations of English *l*: at the beginning of a syllable, as in 'leaf', the *l* is 'light', whereas at the end of a syllable, as in 'feel', the *l* is 'dark', for some speakers even being produced as *w*. It is clear that 'emphatic' is auditorily a contrast in timbre; the term I shall use for that is 'resonance contrast'.

In contrast with Arabic, there are Semitic languages where the emphatics are realized not with backing (pharyngealization / uvularization), but as ejectives. This is typical of the Ethio-Semitic languages, e.g. Tigrinya, to which we now turn.

1.2 Ethio-Semitic Emphatics

The emphatics of the Ethio-Semitic languages are realized differently from Arabic. They are not backed (pharyngealized / uvularized), but are instead ejectives. Thus, for instance, while Arabic *ṭ* is (generally) produced as [tˤ], Tigrinya *ṭ* is produced as [t'].

Ejectives are not especially 'exotic' sounds,[15] although European languages in general do not have phonemic ejectives;[16] there are, however, examples of glottalics in English. For instance, in many varieties of British English, it would not be unusual to hear a word such as *mistake* produced utterance-finally with a final glottalic (ejective) [k'], although it is in no way phonologically contrastive, unlike the ejectives in Ethio-Semitic, which are independent phonemes.

Phonologically contrastive ejectives are in fact very common; ejectives are estimated to be the fourth most common type of stop cross-linguistically,[17] occurring in up to one fifth of the world's languages.[18] An ejective is a consonant made with an egressive glottalic airstream, i.e. the airstream is initiated by glottal action. The production of an ejective is through two (normally) co-occurring constrictions, the first in the larynx (specifically, the glottis is closed), and the second at some point of the supralaryngeal tract; e.g. for an ejective velar stop [k'], in addition to the glottal closure, a closure in the region of the velum is also made. This causes the air to be trapped in the chamber between the velar closure and the closed glottis. An abrupt upward movement of the entire larynx compresses the trapped air, in a piston-like motion, causing a rise in air pressure. When the supralaryngeal (e.g. velar) constriction is released, the air rushes out markedly more quickly (as the air pressure behind the oral constriction is rebalanced with the ambient pressure), and this causes a characteristic 'popping' sound.[19]

Indeed, the main point to be made in this section is that ejectiveness patterns as a laryngeal (phonatory) contrast. There are a number of ways in which segments can vary, which we can think of as parameters. For instance, consonants vary as to their place of articulation, so that a language could have, say, *p* contrasting with *k*, both voiceless stops, and differing only in the place of articulation parameter (one labial and the other velar). Similarly, consonants vary as to their manner of articulation, such that *t* differs from *s* in the degree of constriction, since the former is a stop (the airflow is halted) and the latter a fricative (the incomplete constriction creates friction, but the airstream continues). Another parameter in variation is laryngeal, which is often called voicing; I refrain from the latter term here, because this parameter involves laryngeal action in general, so not just voicing (closely approximated and slack vocal folds set into vibration by the airflow from the lungs), but also aspiration (vocal folds held apart and stiff so that airflow is not impeded). This parameter is what differentiates, e.g., French 'p' from 'b'; in word-initial position, most speakers of French have a voiceless [p] and a (pre-)voiced [b], respectively, so the laryngeal contrast is one of voicing.[20]

Where languages such as English and French have a two-way laryngeal contrast, the Ethio-Semitic languages have a three-way laryngeal contrast in the obstruent series, which is voiced – voiceless (aspirated)[21] – ejective. For instance, Tigrinya has the following among its series of obstruents:

CORONAL STOPS	*d t ṭ* [t’]
CORONAL FRICATIVES	*z s ṣ* [ᵗs’][22]
VELAR STOPS	*g k ḳ*[23] [k’]

What we see for Tigrinya (as for the other Ethio-Semitic languages), therefore, is that ‘emphatic’ is a laryngeal contrast, in parallel with ‘voiced’ and ‘voiceless aspirated’.

To sum up, this section has considered two different types of emphatics. Those of Arabic are typically consonants which are distinguished by backing (pharyngealization / uvularization); those of Ethio-Semitic are ejectives. The two different types of emphatics are distinct enough phonetically that there is no obvious connection, i.e. typologically, pharyngealized consonants do not pattern with ejectives; one would not predict that ejectives would be cognate with pharyngealized consonants in a related language, or that one would historically become the other.

It is clear that the function of ‘emphatic’ is different in the phonological systems of these language types. We may thus contrast ‘emphatic’ as a resonance contrast (e.g. Arabic) with ‘emphatic’ as a laryngeal contrast (e.g. Ethio-Semitic). As noted above, (North East) Neo-Aramaic and MSA appear to have systems in which ‘emphatic’ is not clearly either one or the other (resonance contrast or laryngeal contrast), but rather, something of both. This indicates even more clearly that it would be instructive to consider any historical basis for this. We now, therefore, move on to look at Common Semitic and the ‘ejectives hypothesis’, before returning to our main focus in this paper, which is the patterning of emphatics in different dialect types of Arabic.

2 The Ejectives Hypothesis

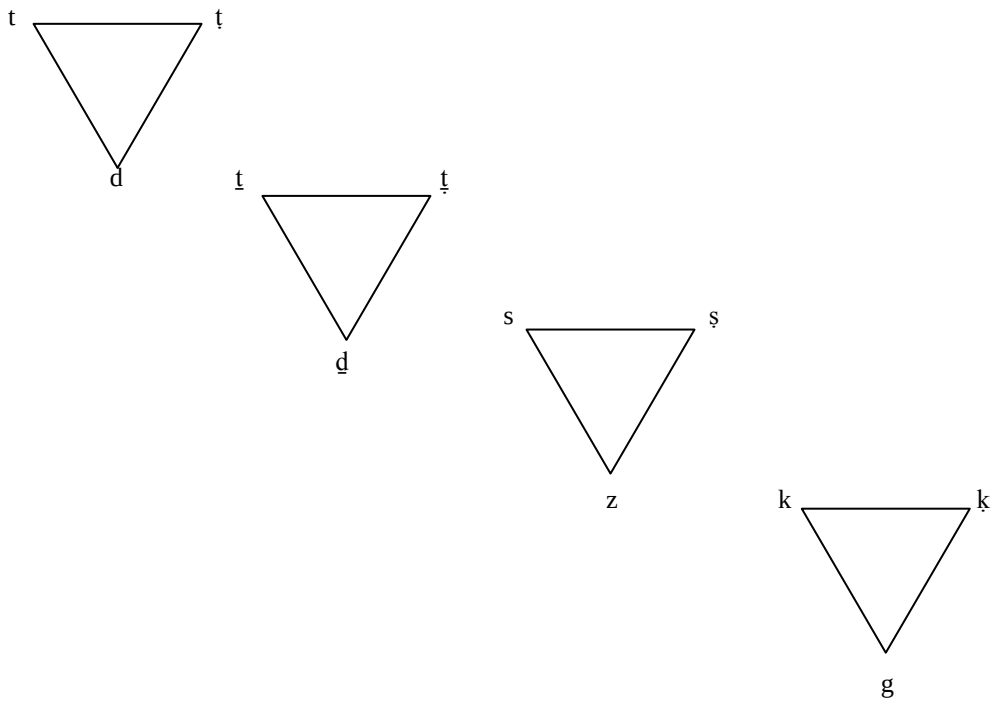
There has been debate in the literature over the exact identity of the earlier Semitic emphatics. What may be termed the ‘ejectives hypothesis’, i.e. that the earlier Semitic emphatics were ejectives (with Arabic-style backed emphatics being a later development), has become probably the more widely accepted view nowadays, but this is not the universal view. Among those holding that Arabic-style emphatics were the earlier form, for instance, are (or were) Brockelmann, Bergstrasser, Leslau, Ullendorff and Kaye;[24] this is also implied by the reconstructed consonant system given for Proto-Semitic in Moscati et al.[25] Under this view, it is assumed that the Ethiopic languages have borrowed ejectives from the neighbouring Cushitic languages. In the main, proponents of this view are those who assumed that Semitic spread originally from Arabia into the Horn of Africa; when this view is challenged, it becomes harder to maintain the view that earlier Semitic emphatics were of the Arabic-style.[26]

By contrast, scholars such as Cantineau and Martinet reconstruct ejectives as the earlier form of emphatics (with **ḍ* being lateral[ized]).[27] The work of Steiner on ‘affricated ṣade’ in Semitic also constitutes evidence for the ejectives hypothesis.[28] There are various additional arguments, ranging from the typological, to the voiceless specification of the emphatic series,[29] to empirical data,[30] that support the ejectives hypothesis.[31]

If one accepts the position that the earlier Semitic emphatics were ejectives, then the view must be that ‘emphatic’ in early Semitic was thus a laryngeal (phonatory) contrast, and not a resonance contrast. In this respect, the role of ‘emphatic’ within Semitic sound systems displays a change from laryngeal to resonance contrast.

We can now see that what is commonly reconstructed for (Proto-)Semitic is a series of triads:[32]

Figure 1 The Semitic triads[33]



In concordance with the evidence that earlier Semitic emphatics were ejectives, it is clear from Figure 1 that the triads presented here are all series of obstruents (the laterals I have already dealt with differently). 'Emphatic' was thus part of a laryngeal opposition voiced – voiceless – emphatic within the obstruent series of the Semitic system.

To conclude this section, I reiterate that among the reasons it is important to look at the historical context is that the data presented later in this paper constitute evidence for trajectory of emphatic development along the lines of that proposed by Dolgopolsky. Arabic dialects themselves show how the role of emphatics within Semitic sound systems has changed (from a solely laryngeal contrast historically to a contrast which is solely one of resonance, in some varieties of Semitic languages today), and how this change can be seen in progress and measured.

3 Laryngeal Categories

As clear from the discussion above, languages' plosive (stop) systems have varying laryngeal categories. French, for instance, has a two-way contrast between voiced and voiceless stops, while Ethio-Semitic languages such as Tigrinya have a three-way contrast in their stop series between voiced, voiceless aspirated and ejective (emphatic). In this section, I discuss laryngeal categories further, and outline how these may be measured, in order to show in the following section how we may apply this to Arabic.

I noted above that the most common type of stop cross-linguistically is voiceless unaspirated, or what may be termed 'plain voiceless'. In phonological terms, we can consider this the unmarked, or default, value, having no (positive) distinctive feature specification.[34]

Among the laryngeal categories found cross-linguistically are the following, with examples of languages and data for the labial series (in word-initial position) for each:

Table 1 Laryngeal contrasts for voicing and aspiration

	Hawaiian	English	French	Thai	Gujarati
voiced			*beau* ‘fine’	*bàa* ‘shoulder’	*baɾ* ‘twelve’
voiceless	*puka* ‘gate’	*bin*	*peau* ‘skin’	*pàa* ‘forest’	*pɔɾ* ‘last year’
voiceless aspirated		*pin*		*pʰàa* ‘split’	*pʰɔdz* ‘army’
voiced aspirated (breathy)					*b̤aɾ* ‘burden’

Table 1 shows examples of a language with no laryngeal contrast (Hawaiian); two languages with differing two-way laryngeal contrasts (English, as an aspirating language, and French, as a voicing language); a language with a three-way contrast (Thai); and a language with a four-way contrast (Gujarati). These contrasts involve only voicing and aspiration, however. Including another type of laryngeal contrast here, glottalization, we add two further possibilities, i.e. ejectives and implosives, with five-way laryngeal contrasts examplified for the labial series in Table 2.

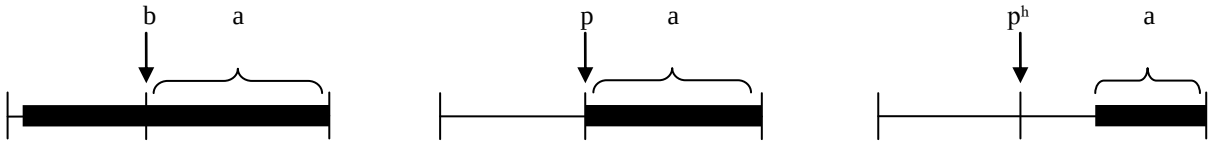
Table 2 Laryngeal contrasts for voicing, aspiration and glottalization

	Uduk	Sindhi
voiced	*baʔ* ‘be sth.’	*bənu* ‘forest’
voiceless	*pàl* ‘try’	*pənu* ‘leaf’
voiceless aspirated	*pʰàlal* ‘centipede’	*pʰənu* ‘snake hood’
voiced aspirated (breathy)		*b̤ənəɳu* ‘lamentation’
glottalic ejective	*pʼàcʰàdˀ* ‘fermented’	
glottalic implosive[35]	*ɓàʔ* ‘back of neck’	*ɓəni* ‘field’

The term ‘voicing’ refers to vocal fold vibration. When the vocal folds are approximated and slack (as opposed to being held stiffly), air passing through sets the vocal folds into vibration, which creates the effect that is perceived as voicing. With a voiced plosive which is word-initial, as for example in French *beau*, the voicing (vocal-fold vibration) starts before the release of the oral constriction; that is, in this case, before the lips start opening. This time difference can be measured acoustically to give the voice onset time (VOT), usually expressed in milliseconds (ms). When the voicing starts before the release of the oral constriction, the VOT has a negative value. When the voicing starts approximately concomitantly with the oral release, as for a ‘plain voiceless’ plosive, the VOT value will be somewhere around zero (although typically there will be a small positive value, perhaps up to around 10–15ms). Aspiration is also measured in this way. In producing a voiceless aspirated stop, the vocal folds are typically tensed and held stiffly apart, allowing air to flow through, and the relative stiffness of the vocal folds preventing vibration from occurring instantly, so that a brief period of airflow overrides the start of the following sound; where this is a vowel, as in the examples in Tables 1 and 2 above, this is perceived as a small puff of air. When a voiceless aspirated stop is measured acoustically, the VOT value will have a positive value above around 20–25ms.[36] For example, in Lisker & Abramson’s seminal study of VOT, their mean values for English voiceless stops were: *p* 58ms; *t* 70ms; *k* 80ms.

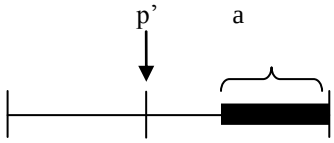
Schematically, this can be exemplified as in Figure 2, below, where voicing is represented as a horizontal black bar, with the x-axis representing time and the downward arrow showing the release of the labial stop for (hypothetical) [ba], [pa] and [pʰa].

Figure 2 Laryngeal contrasts shown schematically for (respectively) labial voiced, voiceless, voiceless aspirated stops



In addition to the voicing and aspiration contrasts that may function as laryngeal categories, and for which one of the main perceptual cues is VOT,[37] glottalization (in the case of obstruents, creating ejectives and implosives) also functions as a laryngeal contrast. This may be exemplified schematically, for [p'a], as in Figure 3.

Figure 3 The ejective laryngeal contrast shown schematically (for comparison with Figure 2)



While the exact VOT zones associated with a particular laryngeal category may vary, it is not uncommon that in a language that has voiceless aspirated stops and ejectives, both may have similar VOT zones. For example, a comparative acoustic study of stops in Tigrinya found the following VOT values for the voiceless aspirated and voiceless ejective stops:[38]

t [tʰ] mean VOT 43ms (range 26–65ms)[39]
ṭ [t'] mean VOT 53ms (range 34–69ms)
k [kʰ] mean VOT 65ms (range 49–79ms)
ḳ [k'] mean VOT 52ms (range 41–64ms)

There is no clear – significant – difference in VOT values between the voiceless aspirates and the ejectives. VOT is not the only necessary factor in discriminating laryngeal categories. With, for instance, ejectives, what seems to be key is that the period of voicing lag (the period between the release of the stop and the onset of glottal pulsing indicating voicing in a sequence such as [p'a]) is effectively silent in comparison with the voicing lag of an aspirate. That is, the 'puff of air' of an aspirate created by the vocal folds being held 'stiff but open' causes the acoustic effect known as noise ('white noise'); in contrast, with an ejective, the increased intraoral air pressure causes a comparatively sharper 'burst' to accompany the release of the stop, followed by a period of silence before the glottal closure is then released. That is, the glottis is closed (the vocal folds are 'stiff but closed') during the production of an ejective, and typically, as with Tigrinya ejectives, the glottis remains closed for a short period after the oral constriction is released.[40] Since the closed glottis prevents airflow, this period – which of course is the period of voicing lag – is perceptually one of effective silence. To sum up, we could give the following perceptual categorisations for the relevant laryngeal categories that have been discussed here:

voiced stops	*voice lead*
'plain' voiceless stops	*no lag*
voiceless aspirated stops	*noise lag*
(voiceless) ejectives	*stop lag*

In other words, there is a perceptual distinction[41] between (so-called 'tense') ejectives of the Tigrinyan kind and voiceless aspirates which may be characterized as 'noise lag' vs 'stop lag'. Therefore, we now see that the Ethio-Semitic triads are formed through the following contrast: voiced (perceptually: voice lead) vs voiceless aspirated (perceptually: noise lag) vs emphatic = voiceless ejective (perceptually: stop lag).

Having seen how laryngeal contrasts may be measured, we can now move on to the core of the paper, which concerns laryngeal categories in Arabic dialects.

4 Arabic Laryngeal Categories: Dyads vs Triads

It seems often to be assumed that in Arabic the oppositions involving laryngeal contrasts are two-way. That is, that we should find the following among the oppositions:

t – d

ṭ – ḍ[42]

Section 1, above, discussed how 'emphatic' in Arabic phonological systems is a resonance contrast, rather than a laryngeal contrast as we find for Ethio-Semitic. Therefore, we may expect to find that while different dialects have slightly different laryngeal settings phonetically (e.g. one dialect may generally aspirate the voiceless stops more than another dialect), there is no clear systemic or phonological difference. That is, we may expect to find that emphatics differ from non-emphatics only in terms of resonance (i.e. emphatics are backed, while non-emphatics are not), and there should be no systematic, predictable difference in laryngeal contrast between emphatics and non-emphatics. Therefore, we may be justified in expecting to find the two-way oppositions, as above, between *t – d* and *ṭ – ḍ*.

However, this is not always the case. There are speakers of Arabic for whom there is indeed a two-way laryngeal distinction, such that *d b* (etc.) are voiced and *t k ṭ q*[43] are voiceless (and if aspirated, then all similarly aspirated). Importantly, however, there are speakers of Arabic for whom there is a three-way laryngeal contrast between voiced stops (*d b* etc.), plain voiceless stops (emphatic *ṭ*, and *q* if present), and voiceless aspirated stops (the voiceless non-emphatics, i.e. *t k* etc.). It is important to note that this contrast is predictable and, moreover, that it is not idiolectal but systematic dialectal variation. In this section I discuss specific case studies showing this variation to be systematic and dialectal, and I outline how dialects can be typologically classified as dyadic or triadic according to this distinction.

The first scholar to show awareness of a three-way laryngeal contrast in Arabic was the eighth-century grammarian Sībawayh.[44] He regarded each *ḥarf* (in this context, 'speech sound, segment') of Arabic not just as an indivisible whole, but as being composed of a set of 'features' (*ṣifāt*, lit. 'characteristics, traits'). Rather than simply describing the articulation of each segment, he grouped them according to shared characteristics. Among these, he classified segments into *majhūr* and *mahmūs*. These two terms have been the subject of some debate and have often been inferred as relating to 'voiced' and 'voiceless' (some scholars prefer 'fortis' and 'lenis'), respectively. However, he classified the voiceless emphatic *ṭ* and the uvular stop *q* (which is derived from historical *ḳ*) as *majhūr* (lit. 'loud, audible') and not *mahmūs* (lit. 'whispered, murmured'), indicating that *ṭ* and *q* were of a different laryngeal status than the voiceless stops *t* and *k*, which he classified as *mahmūs*. Rather than such a classification indicating that *ṭ* and *q* were historically voiced,[45] it is just as likely to mean that *t* and *k* were aspirated, and that *ṭ* and *q*, along with the voiced stops, were not.[46] At the very least, it shows that *ṭ* and *q* were not of the same laryngeal category as the non-emphatic voiceless stops.

In general, however, there has been little attention paid to Arabic laryngeal categorization cross-dialectally, or from a comparative viewpoint.[47] While there have been references in the literature (grammars of various dialects) to whether a stop was generally aspirated,[48] there was no systematic comparative investigation of this until a study by Heselwood in 1996 of (Muslim) Baghdadi[49] and Cairene Arabic.[50] He performed an experimental analysis of *t* and *ṭ* word-medially and word-initially by four speakers of each dialect. He found that for Cairene Arabic, both *t* and *ṭ* are voiceless and aspirated. Both had quite a range of VOT values, but for each speaker, the ranges and means of the VOT values for *t* and *ṭ* are extremely close. This contrasts with Baghdadi Arabic, for which *t* is voiceless aspirated and *ṭ* is 'plain' voiceless (with short lag), and the VOT values for *t* tend to be roughly double those for *ṭ*.[51] Heselwood concluded that this variation was significant and that it is a

dialect feature; rather than being an arbitrary difference, however, he concluded that it was due to a historical change, i.e. the development of emphatics (from ejectives).

Prior to the current work,[52] however, Heselwood's was the only study to investigate this as a dialectal difference. There have been a few other studies to have investigated VOT of stops in various dialects. For instance, Yeni-Komshian et al. investigated phonation in Lebanese Arabic.[53] Their results showed that for the Lebanese speakers they tested[54] there was very little variation in mean VOT values for the voiceless stops *t ṭ k q*,[55] such that there was clearly only a 'voiceless' category for *t ṭ k q*, in opposition to a voiced category. That is, for the Lebanese speakers tested, laryngeal contrast is only two-way. Strikingly similar results were obtained in a subsequent study carried out by Jesry[56] for Syrian speakers of Arabic,[57] who also thus had a two-way contrast between voiced and voiceless.[58] Overall, these results indicate that for these Lebanese and Syrian subjects, all four voiceless stops are what would be considered 'short-lag' stops, being somewhere between the norms for voiceless stops in French or Spanish (unaspirated) and voiceless stops in English (aspirated, long lag).

Further to the investigations discussed above, acoustic analysis was conducted for a number of (Mashriqi) dialects to begin to investigate this more systematically in order to begin building a typology of Arabic dialects.[59] This study revealed not only systematic dialectal variation, but also an apparent correlation with dialect type.

The first analysis was of Baghdadi Arabic. The tokens analysed were taken from the CDs accompanying Alkalesi's Iraqi Arabic course.[60] The results[61] clearly corroborated Heselwood's analysis of Baghdadi Arabic that both *t* and *k* are voiceless aspirates, while *ṭ* and *q* are 'plain' voiceless (i.e. unaspirated). The mean VOT values for *t* and *k* were more than double those for *ṭ* and *q*, respectively.

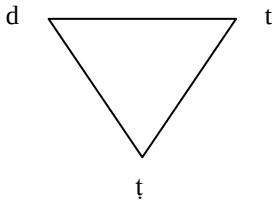
The second analysis was of Saudi Arabian speakers, from the KACST Arabic Phonetic Database.[62] The results[63] showed that for these Saudi speakers, too, VOTs for *t* and *k* are at least double those for *ṭ* and *q*; thus, there is a three-way laryngeal contrast, with *ṭ* and *q* being 'plain' (unaspirated) voiceless and *t* and *k* being voiceless aspirated.

Subsequent informal analyses of small amounts of data recorded from other speakers of Mashriqi dialects have shown equally interesting results. For Syria, not all speakers that I have tested have a two-way contrast. While all speakers from Damascus whom I have tested have a two-way contrast, as per the studies for Levantine dialects discussed above, a speaker from a rural area of north-eastern Syria recorded in January 2010 had a three-way contrast, that is, unaspirated *ṭ q*[64] and aspirated *t k*. This is not entirely unexpected, given that dialects in the Levant (at least) are known to vary particularly along an urbanite – ruralite (sedentary) – Bedouin continuum.[65] The speaker from north-eastern Syria who had a three-way laryngeal contrast could be said to have a rural–Bedouin background; thus, the difference from the urban dialects of the Levant is not unexpected.[66] A female speaker of Ammani Arabic recorded in May 2009 had a three-way laryngeal contrast.[67] A young female speaker from Bahrain,[68] whose accent was of the ʿArab (Sunnī) type,[69] had a two-way laryngeal contrast, with markedly aspirated *ṭ t k*.[70] Other speakers from Iraq (three middle-aged males from Baghdad and a middle-aged male from Wāsiṭ, a *gilit*-speaking area in eastern Iraq) had a three-way contrast, as expected.

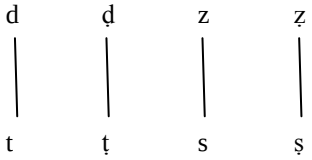
To conclude this section, Arabic dialects fall into two different types with respect to laryngeal categories. There are dyadic dialects, i.e. those which have a two-way laryngeal contrast between voiced and voiceless stops, and there are triadic dialects, i.e. those which have a three-way laryngeal contrast between voiced, voiceless (unaspirated) and voiceless aspirated stops. The two systems can be schematized as in Figure 4, below.

Figure 4 Arabic laryngeal contrasts

a. Triadic



b. Dyadic



We can thus begin to set up a typology to see how far these classifications correspond with dialect type. Triadic dialects include San'aani, Baghdadi and other *gilit* Mesopotamian, at least some Ammani, rural–Bedouinite north-eastern Syrian, some Saudi (as discussed above), Negev and northern Sinai Bedouin, Fes and Meknes Moroccan.[71] Dyadic dialects include at least some ʿArab (Sunnī) Bahraini,[72] urban Syrian Damascene, Lebanese, Cairene. Those Mashriqi dialects which emerge as triadic in this analysis are typically seen as Bedouin(-origin) or (sedentary) rural; those which are dyadic are mostly the urban dialects of the Levant, with the marked exception of the one ʿArab (Sunnī) Bahraini speaker for whom a very small amount of data was informally measured. While this is in no sense a comprehensive study, the data is sufficient to allow a testable hypothesis to be formulated.

For such a typology to be useful more broadly, it is necessary also to investigate the extent to which other features of the sound system correlate with the laryngeal categories. Thus, a typology which is based essentially on socio-economic variables (or 'ecological', as the Bedouin–ruralite–urbanite continuum has been termed),[73] may have a number of related linguistic variants. Since the variance of laryngeal categories is hypothesized to be due to the changing function and nature of the Semitic emphatics, it follows that other linguistic features that may be relevant in the kind of typology under discussion would be those that are also related to the emphatic system and which are also known to vary. There has been much discussion in the literature of factors such as the spread of 'emphasis' as a resonance feature, but the analyses differ so greatly, and the topic so huge, that it is not possible to discuss these in the current paper.[74] Therefore, the focus here remains on the changing shape of the consonant system. Section 6, below, thus discusses a sound system feature that may be expected to correlate with the dyadic or triadic nature of a dialect's system of laryngeal contrasts: interdentals.

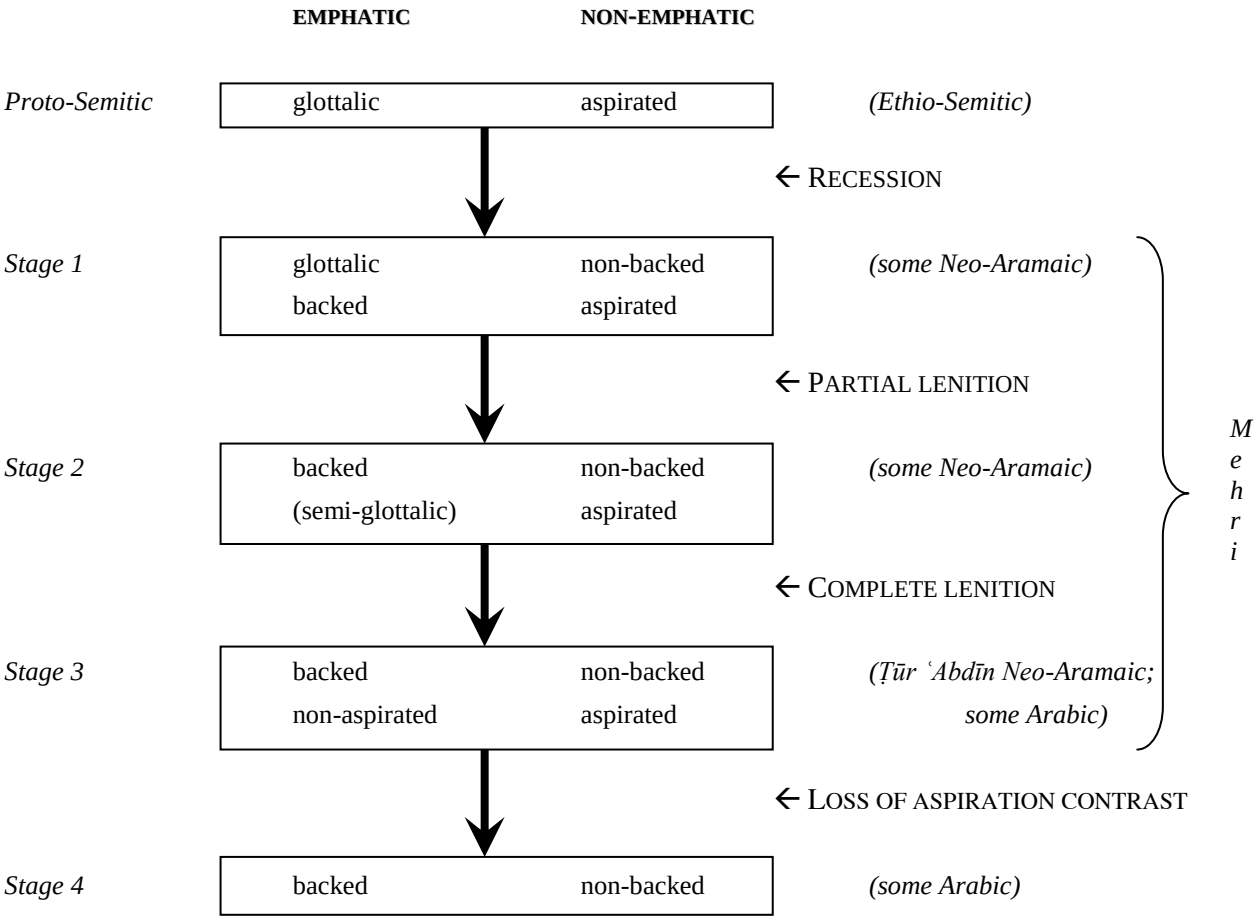
Before turning to this last feature, however, I shall finish the discussion of laryngeal categories by outlining how typologizing Arabic dialects as dyadid or triadic is relevant to Semitic sound systems more broadly. I noted above that the laryngeal system of the triadic dialects is three-way, as is typically Semitic (e.g. as seen for Ethio-Semitic languages such as Tigrinya). That there is evident variation between Arabic dialects today is historically relevant in the broader Semitic context and provides evidence for a trajectory of emphatic development, which is where we now turn our attention.

5 The Changing Function of 'Emphatic' in Semitic

The study so far has shown that 'emphatic' in Semitic has undergone a significant change. I have argued that emphatics in Early Semitic were ejectives, and thus 'emphatic' was a laryngeal contrast. In Arabic, by contrast, emphatics are backed (pharyngealized / uvularized), and this is their defining characteristic; 'emphatic' is therefore a resonance contrast in Arabic. However, Section 4, above, showed that the picture is not quite as clear-cut, since there is evidence in Arabic dialects of 'emphatic' retaining some aspect of its earlier laryngeal contrast function.

It is therefore instructive to look at other Semitic languages in order to investigate the status of 'emphatic'. An important study in this vein is that of Dolgopolsky,[75] who sets up a trajectory of emphatic development from ejective to pharyngealized (backed, as in Arabic), using Neo-Aramaic as the focus, which constitutes three stages along this trajectory. Figure 5 shows the emphatic trajectory, adapted and amended from Dolgopolsky's original.[76]

Figure 5 The emphatic trajectory



As discussed above, the emphatics of Early Semitic were ejectives, while the non-emphatic voiceless stops were aspirated. This is exemplified today in the Ethio-Semitic languages, as shown for the 'Proto-Semitic Stage' of the trajectory in Figure 5. According to Dolgopolsky, in the first stage of the trajectory the glottalic (ejective) articulation of the emphatics causes recession of both the emphatic and the adjacent vowels, which may then spread across the entire word.[77] Therefore, the emphatics are both ejective and backed. The non-emphatic voiceless counterparts are distinctive in being aspirated (but not backed). This first stage is evident in some varieties of North Eastern Neo-Aramaic (Urmian Nestorian [Neo-Assyrian] of the Christians of Urmia / Rezaiye, and some [unspecified] varieties of Kurdistani Jewish Neo-Aramaic).

In the second stage of the trajectory, glottalization is weakened to semi-glottalization, and the distinctive opposition between emphatic and non-emphatic is now perceived as primarily that of aspiration vs backing / non-aspiration. For Dolgopolsky, this stage is represented by the Jewish Neo-Aramaic dialects of north-western Iran and south-eastern Turkey.[78] In this stage, the phonological emphatic vs non-emphatic distinction is perceptually that of aspiration vs backing; since the contrast does not depend on the salience of the laryngeal contrast (glottalization / ejectiveness), 'fortis', or tense, ejective realization is weakened to 'lenis', or lax, and the VOT shortens.

The third stage of the trajectory sees the complete loss of glottalization, and emphatics are now distinguished from non-emphatic voiceless consonants as non-aspirated from aspirated and also as backed from non-backed. This stage is reflected

in the Neo-Aramaic of Ṭūr ʿAbdīn (Turoyo) in south eastern Anatolia. Further, as discussed above, this stage of the trajectory is in fact where we find many varieties of Arabic, i.e. the triadic dialects.

In the fourth and final stage of the trajectory, aspiration is lost and the emphatics are distinguishable only by recession. This is the stage that Dolgopolsky sees as represented by Arabic. As demonstrated above, however, it is only the dyadic dialects of Arabic that exemplify Stage 4. Therefore, what we see through elaborating such a trajectory is that in this sense, the Arabic triadic dialects are more conservative than the dyadic.

A final note here is that it would seem appropriate to add the MSA language Mehri to the trajectory as covering Stages 1–3. In Mehri dialects, the voiceless stops *t k* are aspirated, while the voiceless emphatic stops *ṭ k* are not. The emphatics are pharyngealized / uvularized and cause backing in vowels that follow. However, sometimes they are also realized as ejective, and sometimes not. For example, while *ḳ* is almost invariably ejective, the emphatics of the Mahriyōt dialect of Mehri are realized as ejective only through a process of predictable pre-pausal glottalization; in the Mehreyyet dialect, however, while the emphatics are always backed, *ṭ* is often ejective (contextually conditioned), *ḳ* is almost always ejective, and *d̰* ~ *t̰* is just backed (not ejective).[79] The situation in Mehri is complicated by a process of glottalization that occurs pre-pausally, causing voiced and emphatic obstruents to be realized in this position with glottalization, which usually causes them to be produced as ejectives. Overall, the descriptions of emphatics in other MSA languages are mixed, indicating varying degrees of pharyngealization and / or glottalization, which indicates in turn a considerable degree of mixing in these systems, i.e. transition.

Having now given the historical Semitic context to variation in the systemic function of emphatics, we turn our attention firmly back to Arabic, to look at another variant aspect of dialectal sound systems.

6 Interdentals in the Dyadic / Triadic Systems

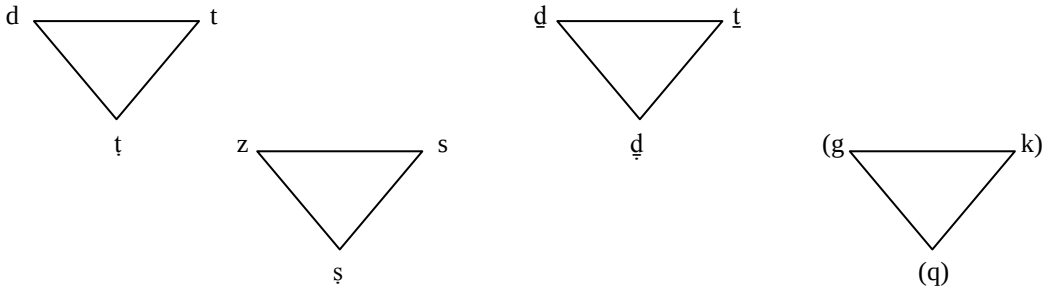
One feature of Arabic sound systems which is known to vary across dialects is the presence vs absence of interdentals. Historically, an interdental triad is posited, so for Proto-Semitic: **t̲ ṯ ḏ̲*. For (what I shall term here) Early Arabic, these interdentals were retained as interdentals, with the only obvious difference being P-S * *t̰* > Early Arabic *d̰*.[80] That is, with the loss of glottalization of the emphatics, the interdental emphatic (now backed) became voiced (this may not be surprising, considering that emphatics seem more likely to pattern phonologically with voiced obstruents than with voiceless aspirates).[81]

Some Arabic dialects have an interdental series, i.e. *t̲ ḏ̲ ḏ̰* (in most cases, historical **ḏ* has merged with the interdental emphatic in such dialects). In other dialects, there is no interdental series, the interdentals instead being realized mostly as *t d ḍ* (with sibilant variants *s z ẓ*, which are generally considered to be classicisms, or in borrowings from Standard Arabic).[82] Occasionally, there is also a labiodental reflex, as for various dialects of the Anatolian group,[83] i.e. *f v ỿ*.

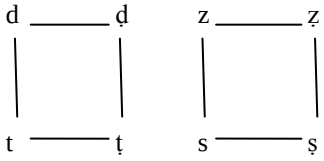
The reason one could posit a potential correlation between the dyadic vs triadic laryngeal contrast systems and the retention vs loss of interdentals is that the functional change of ‘emphatic’ in Arabic sound systems has allowed the triad / dyad series to line up differently. That is, in dialects where the historical three-way laryngeal contrast has merged to a two-way contrast, we find a series of dyadic contrasts between *t–d*, *ṭ–ḍ*, and so on, as shown in Figure 4, above. We could amend the model slightly as in Figure 6, below, which exemplifies the triadic and dyadic systems of Baghdadi and Damascene Arabic.

Figure 6 Triadic vs dyadic systems in Baghdadi and Damascene Arabic

a. Baghdadi: triadic + interdentals



b. Damascene: dyadic, no interdentals



I am not aware of any firm evidence for which of these sound changes may have started happening first, the neutralization of the laryngeal (aspiration) contrast, or the neutralization of the interdentals. It is tempting to suggest a correlation between the two features, in that it is the dialects with no interdentals that are dyadic, and the dialects with interdentals that are triadic, as in Damascene and Baghdadi, respectively. It is not clear, however, to what extent this re-lining up of obstruents within Arabic sound systems is still in transition, so we could expect to find exceptions. The possibilities are: dyadic systems with interdentals (which is the case for the Bahraini ʿArab speaker discussed above); and triadic systems without interdentals.

For the dialects noted above as triadic or dyadic, we can summarize their laryngeal system and status of (historical) interdentals as in Table 3, below.

Table 3 Status of historical interdentals in dyadic and triadic dialects of Arabic

	Dyadic	*Triadic*	*Interdentals?*
Baghdadi and other *gilit* Mesopotamian		✓	✓
San'aani		✓	✓
(some) Ammani[84]		✓	✓
rural–Bedouinite north-eastern Syrian		✓	✓
(some) Saudi[85]		✓	✓
Negev and northern Sinai Bedouin		✓	✓
ʿArab (Sunnī) Bahraini[86]	✓		✓
Damascene	✓		×
Lebanese[87]	✓		?
Cairene	✓		×

From this very small, and admittedly rather unrepresentative, sample, there appears to be a degree of correlation. What we would expect to find is a continuum of development, since these two sound changes may happen at different times, where they are found.

To conclude this section, I note that what has been presented in this paper is part of a longer research project. Having shown that we can classify Arabic dialects as dyadic or triadic in terms of one contrast, I have introduced another variant which appears to be related, i.e. the interdental series. The data show that for the dialects discussed in this paper, there is a

good correlation between triadic laryngeal contrast and interdental retention. Part of the ongoing research project is therefore to incorporate other related variants such as interdental retention, and to investigate comprehensively how far this can be extended across more dialects (and dialect types).

7 Conclusion

This paper has discussed the common realization of emphatics in Arabic, where the most salient articulatory correlate of the emphatic feature is backing (pharyngealization / uvularization), which creates the auditory timbre of darkness. Emphatics in Ethio-Semitic languages, on the other hand, are ejectives, which contrast with voiced and voiceless aspirated obstruents triadically. Therefore, 'emphatic' has different functions in the sound systems of Semitic languages: in Arabic, 'emphatic' is a resonance contrast, while in Ethio-Semitic, 'emphatic' is a laryngeal contrast. Further, there are Semitic languages in which 'emphatic' is neither solely one, nor the other, such systems being mixed (historically transitional).

The emphatics of Arabic, however, are also somewhat mixed and synchronically show evidence of historical transition. This paper has not focused on the resonance contrasts of Arabic emphatics, since this aspect is widely discussed in the literature and is tangential to the focus here. The topic of concern here is on laryngeal categories, since Arabic dialects have variant laryngeal contrasts, reflecting the historical sound change that emphatics have undergone. Arabic dialects may be classified as triadic, with a voiced – voiceless (emphatic) – voiceless aspirated contrast, or dyadic, with a voiced – voiceless contrast. I have argued that taking a typological view of this is useful in building up dialectological classifications, as well as in contributing to the historical picture of Semitic sound systems more broadly.

Early Semitic emphatics are argued to have been ejectives; a trajectory of emphatic development can therefore be set up, with each stage exemplified by various of the Semitic language varieties. Arabic dialects today represent Stages 3 (triadic) and 4 (dyadic) of the trajectory. It seems that having a triadic or dyadic system is not entirely arbitrary, however; from the data presented and discussed here, it seems a reasonable conclusion that there is a correlation between dialect type and laryngeal contrast system. The dialects which are more historically conservative with respect to laryngeal contrast system are most often Bedouinite to ruralite, while the urbanite (Levantine) dialects are those which are more historically innovative in this respect.

Since setting up such a trajectory is a huge undertaking, the results and conclusions presented here are subject to future findings. Work on laryngeal categories is ongoing.

The final section of this paper discussed how other aspects of Arabic sound systems may also be relevant to this typology. The issue of interdentals was brought in, to show how other variants may be incorporated. Interdentals are relevant to an emphatic typology because there are Arabic dialects which have interdentals, contrasting with dialects in which (historical) interdentals have been lost (interdentals most often merging with coronal stops and sibilants). Further, in most of the interdental dialects, both the interdental emphatic *ḏ̣* and historical **ḏ̣* are merged to *ḏ̣*; in the non-interdental dialects, most often the historical lateral **ḍ* and interdental * *ḏ̣* are merged to **ḍ* (~ *ẓ*). Therefore, we see that these two system types are lining up differently. One may therefore hypothesize that there may be a strong correlation between interdental retention / loss and (respectively) triadic vs dyadic laryngeal contrast systems. This final section of the paper presents a brief exploration of the hypothesis and suggests that there may indeed be a good correlation. Nevertheless, exceptions are inevitable, since there is a continuum reflecting historical development; thus, we expect to find systems which are transitional in terms of a historical trajectory. This, too, is the subject of ongoing work which will contribute further to the typology. Overall, the position that I maintain strongly is that emphatics should be viewed, and investigated, in the context of their position within the larger sound system.

ACKNOWLEDGEMENTS

I would like to thank the (anonymized) subjects who were generous enough with their time and their voices to let me record them. I am also very grateful to the following: Janet C.E. Watson, for discussing various aspects of this work, for recording some speakers in Salford, and for sharing her own data with me; G. Rex Smith, who commented on drafts of this paper with much-appreciated attention to detail; Bernard Howard, for providing and digitizing the Tigrinya soundfiles. Any errors are, of course, my own.

NOTES

[1] For further details on, and analysis of, emphatics in Mehri, see Janet C.E. Watson & Alex Bellem, 'A Detective Story: Emphatics in Mehri', *PSAS* 40 (2010), 345–56, and 'Glottalisation and Neutralisation in Yemeni Arabic and Mehri: An Acoustic Study', in Z.M. Hassan & B. Heselwood (eds), *Instrumental Studies in Arabic Phonetics* (Amsterdam 2011) 235–56, and Watson *The Structure of Mehri* (Wiesbaden, in press) 14–17.

[2] Aharon B. Dolgopolsky, *Emphatic Consonants in Semitic* (Israel Oriental Studies 7, Tel Aviv 1977). For more on the manifestation and behaviour of emphatic harmony in North-Eastern Neo-Aramaic, see Robert Hoberman, 'Parameters of Emphasis: Autosegmental Analyses of Pharyngealization in Four Languages', *Journal of Afroasiatic Languages* 1 (1989), 73–97, and original sources therein. Work is ongoing on NENA dialects, in which the behaviour of 'emphasis' is not always easily analyzable (Geoffrey Khan, p.c.; Eleanor Coghill, p.c.).

[3] This consonant, *ḍād*, was historically a lateral, as clearly described by the medieval grammarian Sībawayh (Abū Bishr ʿAmr ibn ʿUthmān ibn Qanbar, *Kitāb Sībawayhi*, ed. ʿAbd al-Salām ʿUthmān ibn Muḥammad Hārūn [Cairo 1982]; see A.A. al-Nassir, *Sibawayh the Phonologist: A Critical Study of the Phonetic and Phonological Theory of Sibawayh as Presented in his Treatise Al-Kitab* [London & New York 1993]). Arabic *ḍ* is cognate with MSA *ẓ́*, which is an emphatic lateral or lateralized consonant; see Janet C.E. Watson & Munira Al-Azraqi, 'Lateral Fricatives and Lateral Emphatics in Southern Saudi Arabia and Mehri', *PSAS* 41 (2011), 425–432. A lateral(ized) realization of *ḍ* is still to be found in some south-western Peninsular varieties of Arabic, and in these varieties is distinct from interdental *ḏ̣* (ibid.).

[4] This latter consonant is most often given in transliteration (rather than transcription) as *ẓ*. I distinguish here between the (emphatic) voiced interdental fricative *ḏ̣* and the (emphatic) voiced alveolar fricative *ẓ*, since an important point is that some (modern) varieties of Arabic have interdentals, while in others the interdentals have merged with the alveolars, and there are thus no interdentals. For example, Damascene *kāẓim* is cognate with Baghdadi *kāḏ̣um* ('Kadhim [boy's name]'). I retain this transcription throughout, for consistency. See my discussion of interdentals in Section 6, below.

[5] This issue is the subject of ongoing debate. In most Neo-Arabic varieties, the reflex of **ḍ* and **ḏ̣* is most often either (merged) *ḍ* (~*ẓ*) or (merged) *ḏ̣*. There are known to be exceptions in some dialects of the Yemen and south-western Saudi Arabia, in which *ḏ̣*, an emphatic interdental fricative, is distinct from *ḍ*, a backed lateral (Janet Watson, p.c.; Watson & Al-Azraqi, 'Lateral Fricatives'). It is most often assumed that in Classical Arabic these two emphatics were distinct; however, the evidence is that by the time of Classical Arabic, for many, if not most, dialects there was no distinction between *ḍ* and *ḏ̣*. However, the evidence of exceptions extant in some Arabic dialects indicates that perhaps the earliest Arabic indeed had a distinction. For the 'merged' view, see Enam al-Wer, 'Variability Reproduced: A Variationist View of the [d] / [D] Opposition in Modern Arabic Dialects', in M. Haak, R. de Jong & K. Versteegh (eds), *Approaches to Arabic Dialects: A Collection of Articles Presented to Manfred Woidich on the Occasion of his Sixtieth Birthday* (Leiden 2004), 21–31.

[6] Some of the peripheral dialects of Arabic do not have emphatics, e.g. Maltese, Cypriot, Chadian, some Nigerian, Juba and Ki-Nubi (Alan S. Kaye & Judith Rosenhouse, 'Arabic Dialects and Maltese', in R. Hetzron (ed.), *The Semitic Languages* [London 1997], 263–311).

[7] In addition to the descriptive grammars of individual dialects, see (among other works discussing this issue): Charles A. Ferguson, 'The Emphatic l in Arabic', *Language* 32:2 (1956), 446–52; Munther Younes, 'On Emphasis and /r/ in Arabic', in M. Eid, V. Cantarino & K. Walters (eds) *Perspectives on Arabic Linguistics VI: Papers from the 6th Annual Symposium on Arabic Linguistics* (Amsterdam 1994), 215–35; John J. McCarthy, 'The Phonetics and Phonology of Semitic Pharyngeals', in P. Keating (ed.) *Phonological Structure and Phonetic Form: Papers in Laboratory Phonology III* (Cambridge 1994), 191–233; Elizabeth A. Card, 'A Phonetic and Phonological Study of Arabic Emphasis', unpublished PhD thesis (Cornell University 1983).

[8] See e.g. Mark W. Cowell, *A Reference Grammar of Syrian Arabic* (Washington, DC 1964), 7. This is discussed further in Alex Bellem, 'Towards a Comparative Typology of Emphatics: Across Semitic and into Arabic Dialect Phonology', unpublished PhD thesis (University of London 2008), 313–4.

[9] For further background and discussion of this and a large number of other sources, as well as analysis, see Bellem, 'Emphatics'.

[10] Ibid. for detailed review of the literature and discussion.

[11] Most noticeably vowels. See e.g. the discussion and analysis of rounding / labialization in Ṣanʿāni Arabic in Janet C.E. Watson, 'The Directionality of Emphasis Spread in Arabic', *Linguistic Inquiry* 30 (1999), 289–300; also Watson, *The Phonology and Morphology of Arabic* (Oxford, 2002). However, see Bellem, 'Emphatics', for detailed discussion and an alternative analysis applied to Baghdadi Arabic. For discussions of labialization in Moroccan Arabic, see in particular: Jeffrey Heath, *Ablaut and Ambiguity: Phonology of a Moroccan Arabic Dialect* (New York 1987); and: Chakir Zeroual, John H. Esling & Philip Hoole, 'EMA, Endoscopic, Ultrasound and Acoustic Study of Two Secondary Articulations in Moroccan Arabic: Labial-Velarisation vs. Emphasis', in Z.M. Hassan & B. Heselwood (eds), *Instrumental Studies in Arabic Phonetics* (Amsterdam 2011), 277–97.

[12] For the original characterization of this phenomenon, see: Bruce Ingham, 'Urban and Rural Arabic in Khūzistān', *BSOAS* 36:3 (1973), 533–53; and: Ingham, 'Regional and Social Factors in the Dialect Geography of Southern Iraq and Khūzistān', *BSOAS* 39 (1976), 62–82. This is discussed in Bellem, 'Emphatics', where it is analyzed as *imāla*, i.e. palatalization, which may be manifest on both vowels and (non-emphatic) consonants, and which interacts crucially with the spread of the emphatic feature, and in some dialects additionally with labialization.

[13] See Bellem, 'Emphatics', and references therein.

[14] E.g. southern Iraqi *gilit* dialects (also discussed in Ingham 'Regional and Social Factors') and San'aani (Watson, *Phonology and Morphology*).

[15] Ejectives were characterized as 'totally indescribable and impossible for a European to acquire'(!) in W.A. Elliott *Dictionary of the Tebele & Shuna Languages with Illustrative Sentences and some Grammatical Notes* (London 1897) (quoted here from Fallon, *Ejectives*, 4).

[16] The two Indo-European languages that are usually cited as an exception are Ossetian and (eastern) Armenian, both of which are found adjacent to areas where various of the Caucasian languages are spoken. The latter are well known for their unusual consonantal systems, which include ejectives. See (among others) Paul D. Fallon *The Synchronic and Diachronic Phonology of Ejectives* [New York 2002].

[17] The most common types of stops, in order, are: 1. voiceless unaspirated; 2. voiced; 3. voiceless aspirated; 4. ejective. See Caroline Henton, Peter Ladefoged & Ian Maddieson, 'Stops in the World's Languages', *Phonetica* 49 (1992), 65–101.

[18] About 18% of languages according to Ian Maddieson, *Patterns of Sounds* (Cambridge 1984); about 20% according to J.C. Catford'Caucasian Phonetics and General Phonetics', *Caucasologie et Mythologie Comparée: Actes du Colloque International du CNRS, IVe Colloque de Caucasologie, Sèvres, 1988* (Paris 1992) .

[19] It is pertinent here to note that this is a brief overview; there are cross-linguistic differences in the articulation of ejectives, and indeed their phonological behaviour, but these are not relevant to the current paper. The reader is referred to Fallon, *Ejectives*, which is a detailed typological study.

[20] There is a well-known typological distinction between 'voicing' languages, such as Dutch, French, Spanish, and 'aspiration' languages, such as English and German, going back to Roman Jakobson, 'On the Identification of Phonemic Entities', *Travaux du Cercle Linguistique de Copenhague* 5 (1949) 205–213. See Section 3, below, on Laryngeal Categories.

[21] The voiceless stops are significantly aspirated, as shown by experimental evidence in Bellem, 'Emphatics', Chapter 2. Tigrinya therefore does not have a 'plain', or unmarked, series, since all stops are lexically specified for a laryngeal feature.

[22] While this is phonetically an affricate, it is clearly the third member of the coronal fricative series, and phonologically / systemically behaves so (e.g. cognates in other Semitic languages). Due to the mechanics of the production of an ejective, ejective fricatives are much harder to maintain: the continuous egressive airflow through the approximated supralaryngeal articulators prevents build-up of air pressure; in order to create this, the sound can be affricated. Looking at consonant inventories of languages with ejectives, it is striking that they are most often stops, and quite often affricates, but that ejective fricatives are comparatively rarer. See Henton et al., 'Stops'; Maddieson, *Patterns*; Fallon, *Ejectives*; Bellem 'Emphatics'.

[23] This is cognate with Arabic *q*.

[24] Carl Brockelmann, *Grundriss der vergleichenden Grammatik der semitischen Sprachen* (Berlin 1908–13); Gotthelf Bergstrasser, *Einfuhrung in die semitischen Sprachen: Sprachproben und grammatische Skizzen* (Munich 1928); Wolf Leslau, 'The Semitic Phonetic System', in L. Kaiser (ed.), *Manual of Phonetics* (Amsterdam 1957), 325–9; Edward Ullendorff, *The Semitic Languages of Ethiopia: A Comparative Phonology* (London 1955) 156; Alan S. Kaye, 'Some Remarks on Proto-Semitic Phonology', *Language Sciences* 8 (1986), 37–48, and 'Arabic Phonology', in A.S. Kaye (ed.), *Phonologies of Asia and Africa (Including the Caucasus)*, I (Winona Lake 1997), 187–204.

[25] Moscati et al. briefly outline a couple of arguments for each of these hypotheses, implying if anything that they perhaps favour the ejectives hypothesis; however, the system that they set up for Proto-Semitic, where **ḍ* is included with the emphatics, means that the emphatics in their system cannot be seen as ejective. (Sabatino Moscati et al., *An Introduction to the Comparative Grammar of the Semitic Languages: Phonology and Morphology* [Wiesbaden 1964], 23–4.) See the discussion in Bellem, 'Emphatics', Chapter 4, particularly on **ḍ* as a lateral.

[26] This is further discussed in Bellem, 'Emphatics', Chapter 4. The view that Semitic spread from the Arabian Peninsula – which was thus the Semitic *Urheimat* – into Africa is now pretty much discredited. The main views now are that the Afro-Asiatic *Urheimat* was most likely somewhere around what is now northern Sudan (see Lionel M. Bender, *Omotic: A New Afroasiatic Family* [Carbondale 1975] and 'Upside-Down Afrasian', *Afrikanistische Arbeitspapiere* 50 [1997], 19–34, who argues for the area around the Blue–White Nile confluence; Martin Bernal 'Speculations on Afroasiatic Origins', MS [1980, cited in Bender, 'Upside-Down'] holds that it was further south, while Igor M. Diakonoff, *Semito-Hamitic Languages: An Essay in Classification* [Moscow 1965] and *The Afrasian Languages* [Moscow 1988], proposes further west). On this view, further to the 'second explosion' of Afro-Asiatic somewhere around 8–7000 years ago, by which Semitic–Cushitic moved east into the lands of modern-day Ethiopia, Semitic would then have spread via the Red Sea into Arabia Felix (Bender, 'Upside-Down', especially 32, Map 2).

[27] Jean Cantineau, *Études de linguistique arabe* (Paris 1960); André Martinet, 'Remarques sur le consonantisme sémitique', *Bulletin de la Société de Linguistique de Paris* 49 (1953), 67–78.

[28] Richard C. Steiner, *Affricated Ṣade in the Semitic Languages* (New York 1982). The point on affrication providing further evidence for the ejectives hypothesis is developed in Bellem, 'Emphatics', 183–4; ejective fricatives are often realized with affrication, which is known to be true of Ethio-Semitic and MSA, where some of the ejectives are assumed to be affricates rather than fricatives. I argue that these ejectives are often not phonemically, or at least systemically, affricates, but that affrication is a phonetic effect resulting from the need to maintain enough intra-oral air pressure to produce a salient glottalic release. For an excellent recent discussion of the typology of fricatives, and study of Tigrinya, see Ryan K. Shosted & Sharon Rose, 'Affricating Ejective Fricatives: The Case of Tigrinya' *Journal of the International Phonetic Association* 41:1 (2011), 41–65.

[29] The exception, of course, is **ḍ*, which has been vociferously debated. The evidence falls in favour of Proto-Afroasiatic and later Proto-Semitic **ḍ* being a lateral or lateralized. However, most scholars reconstruct a voiced form for Proto-Semitic (for Afroasiatic, it is reconstructed as a voiceless ejective fricative lateral [ɬ'] by Militarev & Stolbova, and a voiced alveolar laterally released affricate [dl] by Ehret; Alexander Militarev & Olga Stolbova, 'First Approach to Comparative–Historical Phonology of Afroasian [Consonantism]', *Proceedings of the Fifth International Hamito-Semitic Congress, Vienna: Beitrage zur Afrikanistik* 40 [1987 (1990)], 45–72; Christopher Ehret, *Reconstructing Proto-Afroasiatic [Proto-Afrasian]: Vowels, Tone, Consonants and Vocabulary* [Berkeley 1995]). The arguments for **ḍ* being part of a lateral series (as opposed to interdental) are now fairly well accepted, post Cantineau's study of the accumulated evidence ('Le consonantisme du sémitique', *Semitica* 4 (1951), 79–94; reprinted in Cantineau, *Études*). See Richard C. Steiner, *The Case for Fricative-Laterals in Proto-Semitic* (New Haven 1977), Chapter 2, for a good discussion of the literature and the evidence. As argued in Bellem, 'Emphatics', 153–6, we cannot assume that **ḍ* being voiced in itself is evidence against the ejectives hypothesis; it is likely that it wasn't actually an emphatic (didn't function as an emphatic), and even possible that it was a backed lateral **ɮˁ* as far back as Early Common Semitic.

[30] Empirical data from studies on Neo-Aramaic is used by Dolgopolsky to set up his emphatic trajectory (Dolgopolsky, *Emphatic Consonants*); empirical evidence is provided by Heselwood's study based on acoustic data from Cairene and Baghdadi Arabic (Barry Heselwood, 'Glottal States and Emphasis in

Baghdadi and Cairene Arabic: Synchronic and Diachronic Aspects', *Three Topics in Arabic Phonology* [CMEIS Occasional Paper no. 53, Durham January 1996], 20–44); empirical evidence is provided in Bellem, 'Emphatics'.

[31] These are detailed in Bellem, 'Emphatics', 150–3.

[32] There is, of course, in addition a series of three laterals. However, while these are usually included in the triadic scheme, I reject the assumption that the laterals are part of the triadic system, particularly since the triadic laryngeal oppositions are part of the obstruent series, while at least *l* is a sonorant. Bellem, 'Emphatics', 185–90 argues that the lateral series does not have an emphatic (glottalic) member, but instead a sonorant, **l*, and two fricatives (one voiceless, **ɬ*, one voiced and probably backed / pharyngealized, **ɮˁ*), and that it is not actually a triad, but that the two fricatives form a pair, while **l* is part of a pair of liquids with **r*.

[33] What is noticeably missing from the triadic system shown here is a labial (stop) series, although this is usually reconstructed for Proto-Afroasiatic, viz. **p*, **ṗ*, **b*. Proto-Semitic, however, is reconstructed with the labials **p*, **b*, with Proto-Afroasiatic **ṗ*, **b* having merged in Proto-Semitic to **b*. There are no labial fricatives, although in early (or Proto-)Arabic, Epigraphic South Arabian and Ethiopic, Proto-Semitic **p* becomes *f*. There is also no palatal triad.

[34] Working in a theory of phonology in which phonological primes are monovalent, it is necessary only to say that such a segment is not lexically linked to any 'laryngeal' feature; for instance, in Element Theory, plain voiceless stops have no 'laryngeal' element (H or L) in their representation. See Bellem, 'Emphatics', 16–19 and 113–124, for discussion of laryngeal elements and the phonological representation of ejectives; on Element Theory, including an overview of the literature, see Phillip Backley, *An Introduction to Element Theory* (Edinburgh 2011).

[35] Implosives are normally voiced, although there are cases of voiceless implosives discussed in the phonetics literature, e.g. in Igbo. See Peter Ladefoged, *Vowels and Consonants: An Introduction to the Sounds of Languages* (Oxford 2001), 133; Peter Ladefoged & Ian Maddieson, *The Sounds of the World's Languages* (Cambridge, MA 1996), 82; Ian Maddieson, 'Glottalized Consonants', in M.S. Dryer & M. Haspelmath (eds), *The World Atlas of Language Structures Online* (Munich 2011), available online at http://wals.info/chapter/7, accessed on 2012-03-27.

[36] Languages may vary significantly in this respect, and we can consider VOT as being relevant in terms of zones, rather than absolute values. No two tokens of a plosive will have exactly the same VOT. Moreover, place of articulation affects the VOT values of voiceless aspirates, such that VOT increases with relative backness (from anterior to posterior occlusion), i.e. $p < t < k$. Therefore, plosives at different points of articulation will typically have slightly variant VOT zones (or ranges along the VOT dimension), although not enough to be linguistically significant. (Leigh Lisker & Arthur S. Abramson 'A Cross-Language Study of Voicing in Initial Stops: Acoustical Measurements', *Word* 20 [1964], 384–422, and 1970; Peter Ladefoged & Taehong Cho, 'Linking Linguistic Contrasts to Reality: The Case of VOT', in N. Gronnum & J. Rischel (eds), *Travaux du Cercle Linguistique de Copenhague* 31 [Copenhagen 2001], 212–25; see also B. Smith, 'Effects of Place of Articulation and Vowel Environment on Voiced Stop Consonant Production', *Glossa* 12 [1978], 163–75.)

[37] Lisker & Abramson, 'Voicing', as a prelude to many other studies.

[38] Bellem, 'Emphatics', Chapter 2 and Appendix.

[39] Measurements were made of 10 tokens of each type of stop. The tokens were selected from recordings made in 1952 of an adult male native speaker; the soundfiles were made available to me from the archive of the former SOAS Phonetics Laboratory.

[40] Traditionally, ejectives have been typologically classified as either 'tense' or 'lax'; very generally, the 'tense' ejectives would have a longer VOT and sharper release burst (due to comparatively higher intraoral air pressure), while the 'lax' ejectives would have a fairly short, if any, lag time (VOT) and less intense release burst, perhaps marked instead by increased creakiness. With the latter, then, the glottal constriction is released around the same time as the oral constriction. Under this sort of classification, Tigrinya ejectives would be considered rather more of the tense kind, as opposed to, e.g., Hausa, which is typically cited as a language with lax ejectives. This type of typological classification, however, is more recently argued to be misleading and over-simplistic; moreover, it is not clear in what way such differences are linguistically significant (e.g. are they relevant phonologically?). N. Warner, 'Acoustic Characteristics of Ejectives in Ingush', *ICSLP 96 (Proceedings of the Fourth International Conference on Spoken Language Processing)* (1996), 1525–8; Mona Lindau, 'Phonetic Differences in Glottalic Consonants', *Journal of Phonetics* 12 (1984), 147–55; Fallon, *Ejectives*; Didier Demolin, 'Acoustic and Aerodynamic Characteristics of Ejectives in Amharic', *Journal of the Acoustical Society of America* 115:5 (2004), 2610.

[41] I noted previously that VOT is not the only cue to laryngeal contrasts, but it is probably the most salient (Lisker & Abramson 1964). We could add here that for ejectives, the particular sharpness of the oral release burst and / or perhaps some creakiness in the onset of a following phone are also important perceptual cues to the ejectiveness.

[42] Where this is present, of course; as discussed above, many dialects in fact do not have a stop realization of *ḍ*. Orthographical presence, too, may be misleading, although at least for Modern Standard Arabic (however one defines that) *ḍ* is generally considered the voiced counterpart of *ṭ*.

[43] Where *q* is present in that system. As is well known, **q* has variant realizations across the Arabic-speaking world, most commonly /q/ to /ʔ/ to /g/ to /ʤ/ to /k/ (depending on dialect, phonological context and lexical context). See: Haim Blanc, 'The Fronting of Semitic *g* and the *qāl–gāl* Dialect Split in Arabic', *Proceedings of the International Conference on Semitic Studies, Jerusalem, 19–23 July 1965* [1969], 7–37; Kaye & Rosenhouse, 'Arabic Dialects', 270–3; Peter Behnstedt & Manfred Woidich, *Arabische Dialektgeographie: Eine Einführung* (Leiden 2005), Chapters 6-7, Maps 12-14, 16; Catherine Taine-Cheikh, 'Deux macro-discriminants de la dialectologie arabe (la réalisation du *qaaf* et des interdentals)', *Matériaux Arabes et Sudarabiques* (*MAS-GELLAS*) 9 (1998), 11–49; Maher Bahloul, 'Linguistic Diversity: The *Qaaf* across Arabic Dialects', in E. Benmamoun (ed.), *Perspectives on Arabic Linguistics XIX* (Amsterdam 2007), 247–65.

[44] Sībawayh, *Kitāb*. See also (among others): Khalil Semaan, *Linguistics in the Middle Ages: Phonetic Studies in Early Islam* (Leiden 1968); al-Nassir, Sibawayh; M.G. Carter, *Sībawayhi* (Oxford 2004).

[45] Given the definition of voicing as discussed in Section 3, above. This is the argument developed by, among others, Cantineau, *Études*, 31–32, 67–71.

[46] A good discussion of this is in Blanc's important paper on *q* and *g*, in which he argues that 'voicing' is not used as a feature by Sībawayh because it is 'not quite sufficient as a distinctive feature' (p.13) since the voiced consonants may devoice in certain positions, e.g. word-finally, and, essentially, that *ṭ* and *q* are vulnerable to ambient voicing. (Blanc, 'The Fronting of Semitic *g*'; also, Blanc, 'The "Sonorous" vs "Muffled" Distinction in Old Arabic Phonology', in *To Honor Roman Jakobson: Essays on the Occasion of his Seventieth Birthday* [The Hague 1967], 295–308. Blanc himself ['Sonorous vs Muffled', 306–7] refers

to Irene Garbell, 'Remarks on the Historical Phonology of an East Mediterranean Arabic Dialect', *Word* 14 [1958], 303–37, who says [307] that *mahmūs* is 'breathed' and *majhūr* 'non-breathed'.)

[47] The exception, to my knowledge, is a comparative study of San'aani and Cairene phonology and morphology which does look at a two-way laryngeal contrast in Cairene and a three-way one in San'aani, although from a slightly different perspective from that presented here (*Phonology and Morphology*).

[48] This is not investigated instrumentally for the descriptive grammars. In contrast, while instrumental phonetic studies for some dialects have measured laryngeal categories, the comparative aspect is not considered and dialectal variation not made clear. Some examples from descriptive accounts are as follows. San'aani Arabic is noted to have unaspirated *ṭ* and aspirated *t* (Blanc, 'Semitic *g*', 24–5; Hamdi A. Qafisheh, *Yemeni Arabic Reference Grammar* [Kensington, MD 1992], 2; note of course the discussion of laryngeal categories for San'aani and Cairene in Watson, *Phonology and Morphology*, 43). Negev Bedouin has unaspirated *ṭ* and aspirated *t k* (Blanc 'Semitic *g*', 24). Northern Sinai Bedouin has unaspirated *ṭ* and aspirated *t k* (Rudolf E. de Jong, *A Grammar of the Bedouin Dialects of the Northern Sinai Littoral: Bridging the Linguistic Gap between the Eastern and Western Arab World* [Leiden 2000], 61). For Damascene Arabic, the major descriptive account says (impressionistically) that *t* is slightly aspirated, while *ṭ* is not; however, this is not borne out by actual instrumental analysis, which is detailed further in Section 4 of the current paper, nor by other phonetic analyses (Cowell, *Syrian Arabic*; see also Arne Ambros, *Damascus Arabic* [Malibu, CA 1977]). In Fes and Meknes Moroccan, Heath states that *t* has a 'heavily aspirated and often affricate-like release...while /ṭ/ consistently has an abrupt release', and *q* is 'consistently glottalized, with little or no aspiration, while /k/ is never glottalized and usually aspirated' (Jeffrey Heath, *Ablaut and Ambiguity: Phonology of a Moroccan Arabic Dialect* [New York 1987], 13, 17).

[49] Muslim Baghdadi Arabic is a *gilit* Mesopotamian (southern Iraqi) dialect; the nomenclature is to differentiate the Christian and Jewish from the Muslim dialect of Baghdad, since the former are *qəltu* (northern) Mesopotamian dialects. The situation is less clear-cut today, and it may be becoming more appropriate to talk of two (not entirely distinct) varieties of (*gilit*) Baghdadi (Farida Abu-Haidar, 'Speech Variation in the Muslim Dialect of Baghdad: Urban versus Rural', *Zeitschrift für Arabische Linguistik* 19 (1988), 74–80; Clive Holes 'Community, Dialect and Urbanization in the Arabic-Speaking Middle East', *BSOAS* 58 [1995], 270–87). For the communal nomenclature, see Haim Blanc, *Communal Dialects in Baghdad* (Cambridge, MA 1964).

[50] Heselwood, 'Glottal States'.

[51] The actual results were as follows. The sample size was 16 (4 tokens for each of 4 speakers of each dialect). Cairene *t*: group mean VOT (i.e. across the 4 speakers) 33.3ms; group range 16–50ms. Cairene *ṭ*: group mean VOT 35.4ms; group range 15–63ms. Baghdadi *t*: group mean VOT 31.4ms; group range 19–51ms. Baghdadi *ṭ*: group mean VOT 15.5ms; group range 9–31ms.

[52] For the studies discussed here, as well as my results from the analyses of Baghdadi and Saudi Arabic, bar charts are presented in Bellem, 'Emphatics', Chapter 2 which clearly show how these dialects do or do not have different VOT zones for the voiceless stops. The two-way and three-way systems are also compared with Tigrinya, for which acoustic analysis was performed and results presented therein.

[53] G. Yeni-Komshian, A. Caramazza & M.S. Preston, 'Study of Voicing in Lebanese Arabic', *Journal of Phonetics* 5 (1977), 35–48. Their investigation was in fact of variation in VOT as a function of place of articulation and vowel quality; my analysis therefore was of the mean values for each stop across the different vowels (Bellem, 'Emphatics', 70–72).

[54] It is not clear exactly where their speakers were from; their experiment used testing material from 'Classical Arabic'. I note here that the work of Ghada Khattab on Lebanese Arabic VOT production in children also supports the findings of Yeni-Komshian et al. that Lebanese has only a two-way laryngeal contrast in stops (voiced and voiceless) (Ghada Khattab, 'VOT Production in English and Arabic Bilingual and Monolingual Children', in D.B. Parkinson & E. Benmamoun (eds), *Perspectives on Arabic Linguistics XIII–XIV: Papers from the Thirteenth and Fourteenth Annual Symposia on Arabic Linguistics* [Amsterdam 2002], 1–38).

[55] The actual mean values are as follows. The number of tokens measured in total for the four voiceless stops was 192 (8 tokens from each of 8 subjects, for each of 3 target CV sequences, such as *ti*, *ta*, *tu*). *t*: group mean VOT (i.e. across the 8 speakers) 25ms. *ṭ*: group mean VOT 23ms. *k*: group mean VOT 28ms. *q*: group mean VOT 30ms.

[56] Mohammad Maher Jesry, 'Some Cognitively Controlled Coarticulatory Effects in Arabic and English, with Particular Reference to Voice Onset Time', unpublished PhD thesis (University of Essex 1996).

[57] Likewise, Jesry's study also did not state his speakers' backgrounds, only that they were from different parts of Syria. It would be interesting to know where exactly, because while urban dialects (e.g. Damascus, Aleppo) seem to have a two-way contrast, other dialects have a three-way contrast, as discussed in Section 4, below. Based on as-yet untested observations of other speakers, it seems likely that there are rural dialects where a three-way contrast is the norm, whereas for urban dialects a two-way contrast holds. Also of note is that the study was of 'Arabic', the carrier sentence and target words were Standard Arabic, and the stimulus presented orthographically. Target phones were also Standard Arabic. However, while the speakers may (to a greater or lesser degree) be aware of some differences in pronunciation between Standard Arabic and their native dialect, factors such as VOT seem to be unconscious and therefore uncontrolled, even where a speaker is aiming at 'Standard' Arabic.

[58] The actual mean values are as follows. The number of tokens measured in total for the four voiceless stops was 90 (10 tokens from each of 3 subjects, for each of 3 target CV sequences, such as *ti*, *ta*, *tu*). *t*: group mean VOT (i.e. across the 3 speakers) 25ms. *ṭ*: group mean VOT 24ms. *k*: group mean VOT 32ms. *q*: group mean VOT 29ms.

[59] Bellem, 'Emphatics', Chapter 2.

[60] The dialect is described by the author as that of 'middle-class Baghdad', although it is clearly of the *gilit* (Muslim Baghdadi) type. Yasin M. Alkalesi, *Modern Iraqi Arabic: A Textbook* (Washington, DC 2001).

[61] The actual VOT values are as follows. The number of tokens measured in total for the four voiceless stops *t ṭ k q* was 24 (6 tokens of each of 4 stops, all word-initial, all preceding the vowel *a*). *t*: mean VOT 31ms; range 28–37ms. *ṭ*: mean VOT 11ms; range 9–14ms. *k*: mean VOT 39ms; range 31–45ms. *q*: mean VOT 15ms; range 7–24ms. See Bellem, 'Emphatics', Appendix, Table A7.

[62] The database was produced by a speech technology project at the Computer and Electronics Research Institute of King Abdulaziz City for Science and Technology. The database consists of the results of 9 experiments on 7 subjects from different areas of Saudi Arabia conducted between 1984 and 1987. The target consonants were every *ḥarf* (consonantal phone) of Standard Arabic, which meant that *ḍ* and *ḏ* were included separately,

although most often both were produced as interdental fricatives by the subjects. Of the 7 subjects, 6 were originally from the central Najd and 1 from Albaha, in the western Peninsula.

[63] The actual VOT values are as follows. The number of tokens measured in total for the four voiceless stops *t ṭ k q* was 252 (9 tokens from each of 7 speakers, for each of 4 stops). *t*: mean VOT 35ms. *ṭ*: mean VOT 16ms. *k*: mean VOT 44ms. *q*: mean VOT 18ms. See Bellem, 'Emphatics', Appendix, Tables A11, A12, A14.

[64] This speaker most often realized **q* as *ʔ* or *g*. Older speakers of his background would have mostly *g*, but there is a move towards the glottal stop, typical of urban Levantine, for many younger speakers. This speaker was a university graduate in the 30–40 age range who had travelled and was at that time living in Damascus. His dialect was therefore a little mixed, although less than might be expected; he retained interdentals, for instance, and used lexical items such as *bī* 'there is / are' (a Damascene would have *fī* here).

[65] This classification is discussed particularly by Frederic J. Cadora, *Bedouin, Village and Urban Arabic: An Ecolinguistic Study* (Leiden 1992). See also the discussion by Holes, who identifies 'city' dialect types, 'Bedouin' dialect types and 'ruralite' types, and notes that throughout the Middle East, '[t]he overall effect is that of a dialectal patchwork quilt' – this is typical especially of, but not confined to, the Levant (Clive Holes, *Modern Arabic: Structures, Functions, and Varieties* [Washington, D.C. 2004], 70).

[66] This further demonstrates that the dialects of one region (or nation-state) cannot be assumed to have the same phonetic or phonological categories, and it is therefore important to identify a speaker's background more specifically than just, e.g., Syrian or Jordanian. Some of the investigations of VOT in Arabic mentioned have given details only of nationality, which may be misleading.

[67] Ammani Arabic is an interesting case study because of the rapid recent development of an urban dialect which additionally displays gender variation. In common with other urban Levantine dialects, it might have been expected that this speaker (particularly as a middle-class female in her early forties) would have had a two-way laryngeal contrast, since it appears that in Ammani Arabic the *ṭ* is in the process of merging in terms of laryngeal category with *t* (that is, young women may be developing a two-way laryngeal contrast, rather than a three-way) (G. Khattab, F. Al-Tamimi & B. Heselwood, 'Acoustic and auditory differences in the /t/-/t/ opposition in male and female speakers of Jordanian Arabic', in S. Boudelaa (ed.) *Perspectives on Arabic Linguistics XVI: Papers from the Sixteenth Annual Symposium on Arabic Linguistics* [Cambridge 2006], 131–60). See Enam Al-Wer, 'The Formation of the Dialect of Amman: From Chaos to Order', in C. Miller, E. Al-Wer, D. Caubet & J. Watson (eds) *Arabic in the City: Issues in Dialect Contact and Language Variation* (Abingdon 2007), 55–76.

[68] Recorded by Janet C.E. Watson in Salford, May 2009.

[69] As per Holes, 'Community', 274; Bahrain is often cited as an example of communal dialect variation, and discussed in a number of works by Holes. The ʿArab (Sunnī) dialects, which are an offshoot of Najdi dialects (ibid., 272), contrast strikingly with the Baḥārna (Shīʿī) dialects. See also Clive Holes, 'Bahraini Dialects: Sectarian Differences and the Sedentary/Nomadic Split', *Zeitschrift für Arabische Linguistik* 10 (1983), 7–38; 'Patterns of Communal Language Variation in Bahrain', *:Language in Society* 12 (1983), 433–57; *Language Variation in a Modernising Arab State: The Case of Bahrain* (London 1987).

[70] There were no tokens of *q* in the recorded data; historical **q* was realized as *g* (e.g. *gil-na* 'we said').

[71] See footnote 48, above.

[72] Only one speaker was tested for this dialect, on one occasion, and I do not have personal acquaintance with this variety in order to be in a position to comment further.

[73] Cadora, *Ecolinguistic Study*.

[74] This topic is addressed in Bellem, 'Emphatics', in particular Chapters 5, 6. It is the topic of ongoing investigation. The reasons for the problematic nature of gaining data from the literature more widely for this type of analysis are also discussed therein.

[75] Dolgopolsky, *Emphatic Consonants*.

[76] Dolgopolsky defined Stage 4 as being exemplified by Arabic (thus the endpoint of the trajectory); one major amendment, then, is the splitting of Arabic into Stages 3 and 4 (triadic and dyadic dialects, respectively), since, as this paper shows, Arabic dialects are not uniform with respect to laryngeal contrasts. Additionally, Dolgopolsky included MSA at the start-point of the trajectory, i.e. as having only ejective emphatics, akin with Ethio-Semitic, further to the work published by Johnstone from the 1970s which argued (contra previous scholars who had described MSA emphatics as being similar to Arabic) that MSA emphatics were actually ejectives (T.M. Johnstone, 'Contrasting Articulations in the Modern South Arabian Languages', in J. & Th. Bynon, *Hamito-Semitica: Proceedings of a Colloquium Held by the Historical Section of the Linguistics Association at the School of Oriental and African Studies, University of London, 18–20 March 1970* [The Hague 1975], 155–9; 'The Modern South Arabian Languages', *Afroasiatic Linguistics* 1:5 [1975], 93–121; *Mehri Lexicon and English–Mehri Word-List*, ed. G.R. Smith [London 1987]). The status of emphatics in MSA is far less clear-cut, and MSA emphatics turn out to be in various stages of transition; for discussion of this, see Janet C.E. Watson & Alex Bellem, 'A Detective Story: Emphatics in Mehri', *Proceedings of the Seminar for Arabian Studies* (40) 2010, 345–56; and 'Glottalisation and Neutralisation in Yemeni Arabic and Mehri: An Acoustic Study', in Z.M. Hassan & B. Heselwood (eds) *Instrumental Studies in Arabic Phonetics* (Amsterdam 2011), 235–56; Watson, *Mehri*.

[77] Dolgopolsky does not indicate *why* glottalic articulation should trigger backing, but seems to assume it as given.

[78] There are some references in the literature to emphatics of some dialects of Arabic being glottalized. For example, de Jong (*Grammar*, 61) notes for the Rmēliy and Swērkiy dialects of the coastline of north-eastern Sinai (northern Sinai Bedouin dialects) that '*ṭ* followed by a vowel is often accompanied by a degree of glottalization (*...t'*). Such glottalization is especially apparent when *ṭ'* (an "ejective stop", IPA [tʼ] is followed by a stressed vowel.'

[79] Watson, *Mehri*, 16; Watson & Bellem, 'Detective Story'; Watson & Bellem, 'Glottalisation and Neutralisation'.

[80] There is controversy over the interdental emphatic historically in terms of whether it was distinct from *ḍ*. See footnote 5, above.

[81] Heselwood, 'Glottal States', provides a thorough discussion of phonetic motivation behind the voicing of emphatics. Emphatics seem particularly prone to ambient voicing in inter-vocalic position (at least, in triadic dialects where emphatics are not aspirated and thus unspecified for a laryngeal feature). Emphatics in San'aani Arabic pattern with voiced obstruents, in opposition to voiceless aspirates, in pre-pausal glottalization: the voiced consonants and the emphatics are glottalized pre-pausally, while the voiceless aspirates are pre-aspirated (Watson & Bellem, 'Glottalisation and Neutralisation').

[82] See e.g. Ambros, *Damascus Arabic*, 111–12.

[83] This includes all the Siirt dialects, one Mardin dialect and a village in which a Diyarbakir dialect is spoken (Otto Jastrow, *Die mesopotamisch-arabischen Qəltu-Dialekte* [Wiesbaden 1978], 34-5).

[84] One speaker, as noted above; she had interdentals.

[85] These are the KACST speakers, seven of whom were from the Najd region and one from the western coastal area.

[86] One speaker only, as noted above; she had interdentals.

[87] As noted, it was not stated which of the dialects of Lebanon the subjects spoke or exactly where they came from (the testing was of 'Classical Arabic'). Therefore, it is not possible to know whether the subjects had interdentals or not.